

South Dakota State University

## Open PRAIRIE: Open Public Research Access Institutional Repository and Information Exchange

---

ASEE North Midwest Section Annual Conference 2020 Poster Presentations

---

10-2020

### Development of Critical Consciousness Scale for Civil Engineering Students

Tonmoy Sarker

Dr. Cristinia Poleacovschi

Dr. Mollie Appelgate

Dr. Kate Swalwell

Dr. Christa Jackson

*See next page for additional authors*

Follow this and additional works at: [https://openprairie.sdstate.edu/asee\\_nmws\\_2020\\_posters](https://openprairie.sdstate.edu/asee_nmws_2020_posters)



Part of the [Engineering Education Commons](#)

---

---

## **Authors**

Tonmoy Sarker, Dr. Cristina Poleacovski, Dr. Mollie Appelgate, Dr. Kate Swalwell, Dr. Christa Jackson,  
and Dr. Kristen Cetin



## Abstract

- Recent research shows that engineers continue to think less critically at the end of their undergraduate engineering degrees and fail to adhere to their professional responsibility.
- A key component to addressing these issues includes assessing engineers' critical consciousness (CC).
- The development of a Critical Consciousness Scale (CCS) is important for civil engineering education as it assists practitioners and educators with better means to assess whether any interventions (e.g. ABET) are indeed efficacious.
- Building on previous work from Freire (1973, 1993) and Diemer et al. (2014) on critical consciousness scale, three indicators measuring critical consciousness were identified (i.e., Critical Reflection: Perceived Inequality; Critical Reflection: Egalitarianism, and Critical Action: Sociopolitical Perception).
- The CCS proposed in the study includes 46 items that seek to measure critical consciousness, and which were adapted to civil engineering.
- The research addresses the need to build shorter, but valid and reliable measures of critical consciousness and contribute to the extended efforts across the engineering disciplines to examine professional learning outcomes at the individual level.
- Building and testing CCS will directly impact engineering education scholarship since it facilitates exploring the role of diverse interventions of interest on CC in engineering programs.

## What is Critical Consciousness?

- Features the idea of social thinking to uplift the social inequality and empower the community by critical thinking.
- "Critical Consciousness" theory is also conceptualized in civil engineering education to advance engineers' crucial thinking through learning.

## Research Question(s)

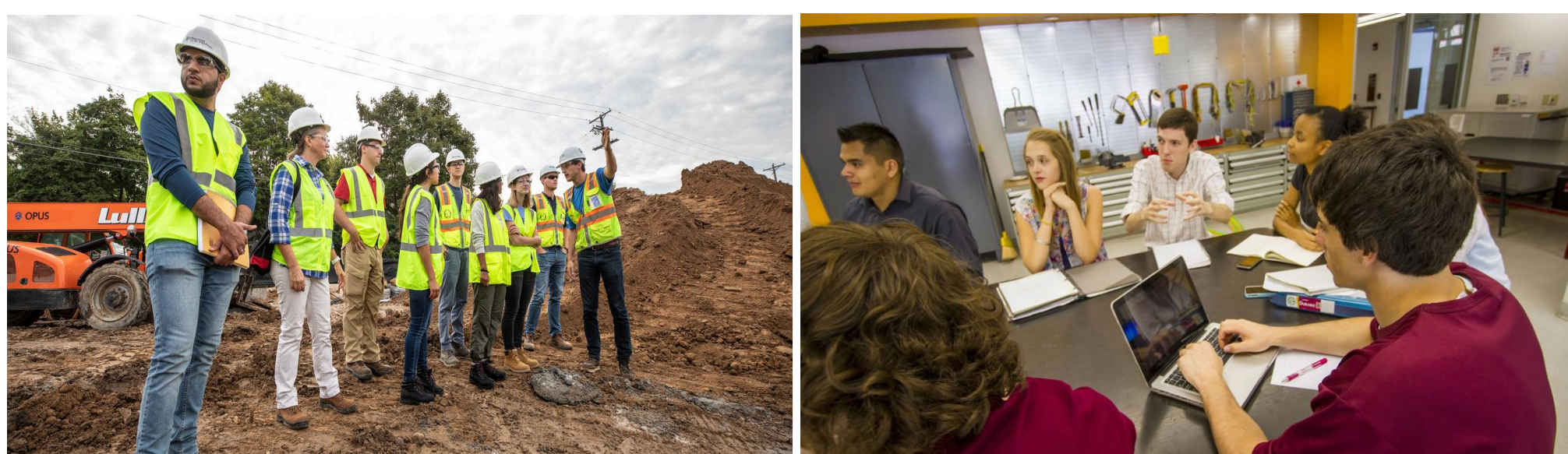
- What are the factors of Critical Consciousness Scale on Civil Engineering Education (CEE)?

## Research Objective(s)

- To identify the factors of critical consciousness in CEE
- Conceptualization and development of Critical consciousness scale for CEE
- Application of CCS for developing CC in Engineering Education



Source: Student participating Politics, bayobserver.ca



## Methodology

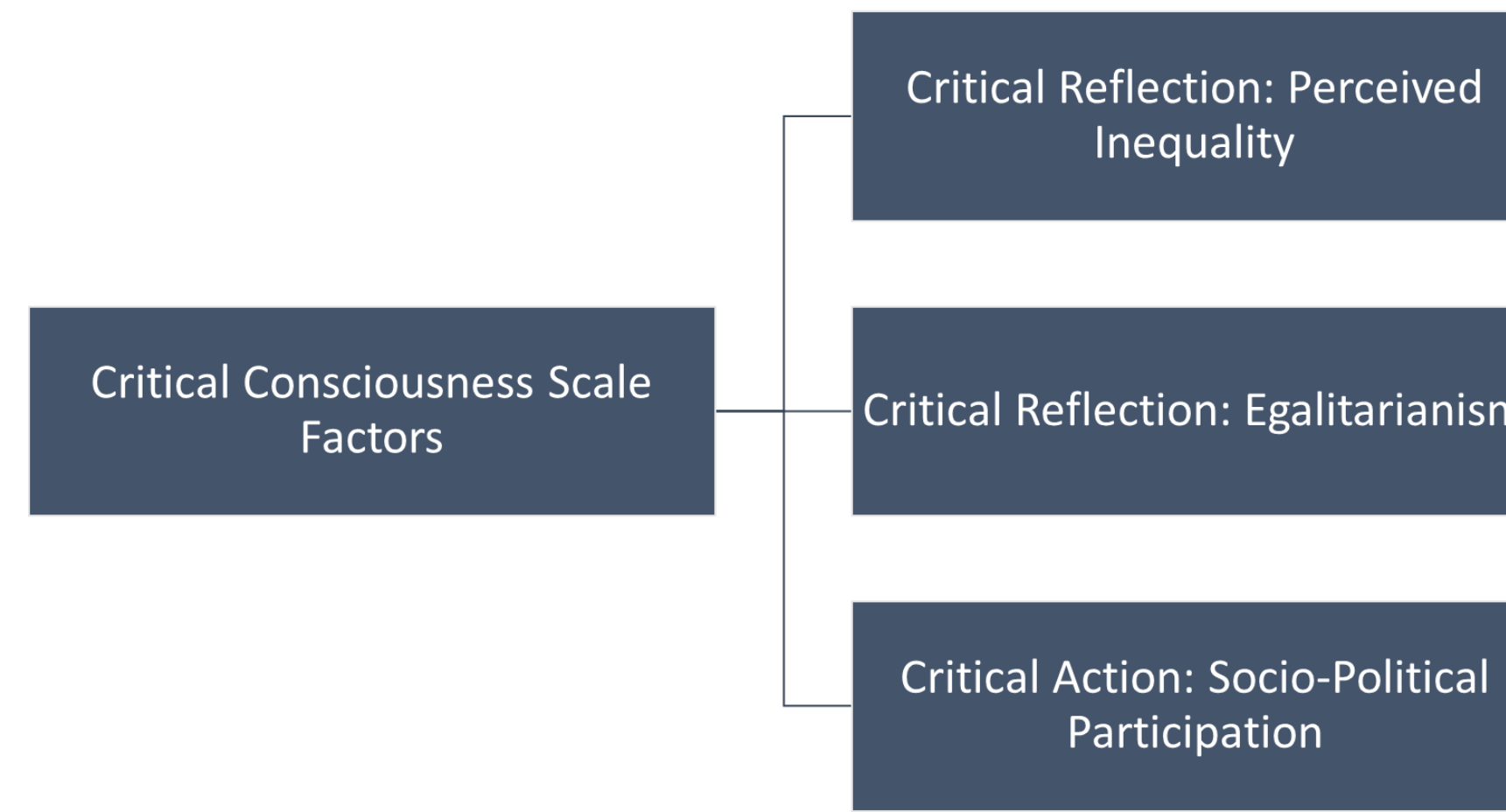


Figure 1: Conceptual Methodology for Critical Scale Development

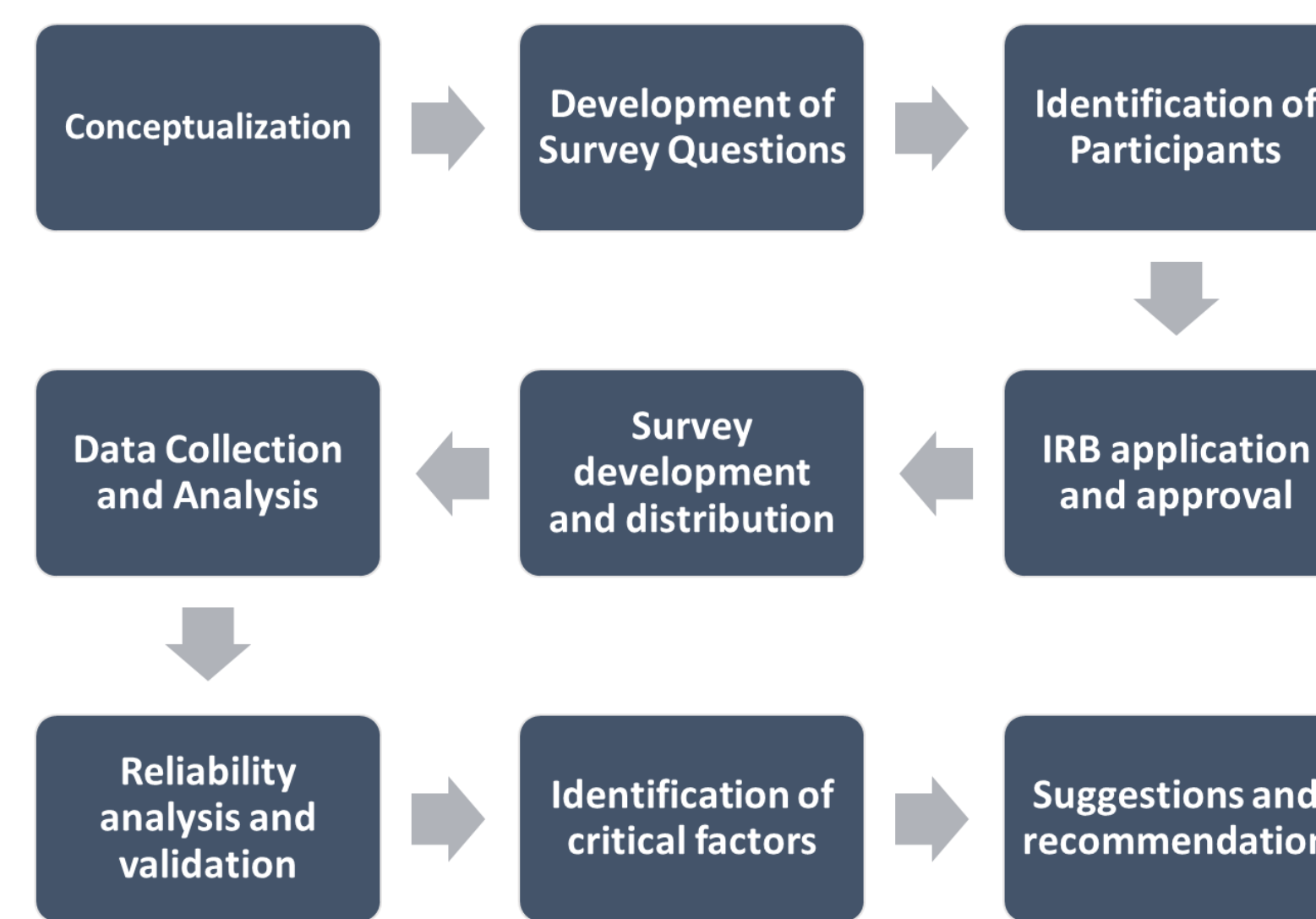


Figure 2: Workflow for developing the Scale

Critical Reflection: Perceived Inequality (20 items)	Critical Reflection: Egalitarianism (12 items)	Critical Action: Socio-Political Action (14 items)
<b>Example</b> <ul style="list-style-type: none"> <li>Certain racial or ethnic groups have fewer chances to get higher education in civil engineering</li> <li>Low-income and first-generation students have fewer opportunities to get into civil engineering or graduate with a civil engineering degree</li> </ul>	<b>Example</b> <ul style="list-style-type: none"> <li>Low-income and first-generation students have fewer opportunities to get into civil engineering or graduate with a civil engineering degree</li> <li>Certain racial or ethnic groups have fewer chances to get higher education in civil engineering</li> </ul>	<b>Example</b> <ul style="list-style-type: none"> <li>I participated in a group or organization in college that promotes minority rights and addressing social inequities</li> <li>I participated in a political party, club or organization in college that advertises minority rights and addressing social inequality in civil engineering</li> </ul>

Figure 3: Factor-based approach

In this section we will ask you about the social inequalities for some events.

Can you please rate level of agreement with the following events below?	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
1. Certain racial or ethnic groups have fewer chances to get higher education in civil engineering	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Low-income and first-generation students have fewer opportunities to get into civil engineering or graduate with a civil engineering degree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Racial or ethnic minority groups have fewer chances to get civil engineering jobs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. Women have fewer opportunities to get civil engineering jobs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. Low-income and first-generation students have fewer options to get good jobs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Can you please rate the frequency of your participation with the following events below?

	Never	Rarely	Sometimes	Often	Always
1. I participated in a group or organization in college that promotes minority rights and addressing social inequities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. I participated in a political party, club or organization in college that advertises minority rights and addressing social inequality in civil engineering	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. I wrote a letter to the university, department, community newspaper, or publication about promoting minority rights and addressing social inequities in civil engineering	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Figure 4: 5-point Likert scale Factor-based approach



Qualtrics Survey: QR Code



Source: Black Students' matter, npr.org (Tom Williams/CQ-Roll Call via Getty Images)



Source: Civic Engagement, Youth.gov

## Analysis technique

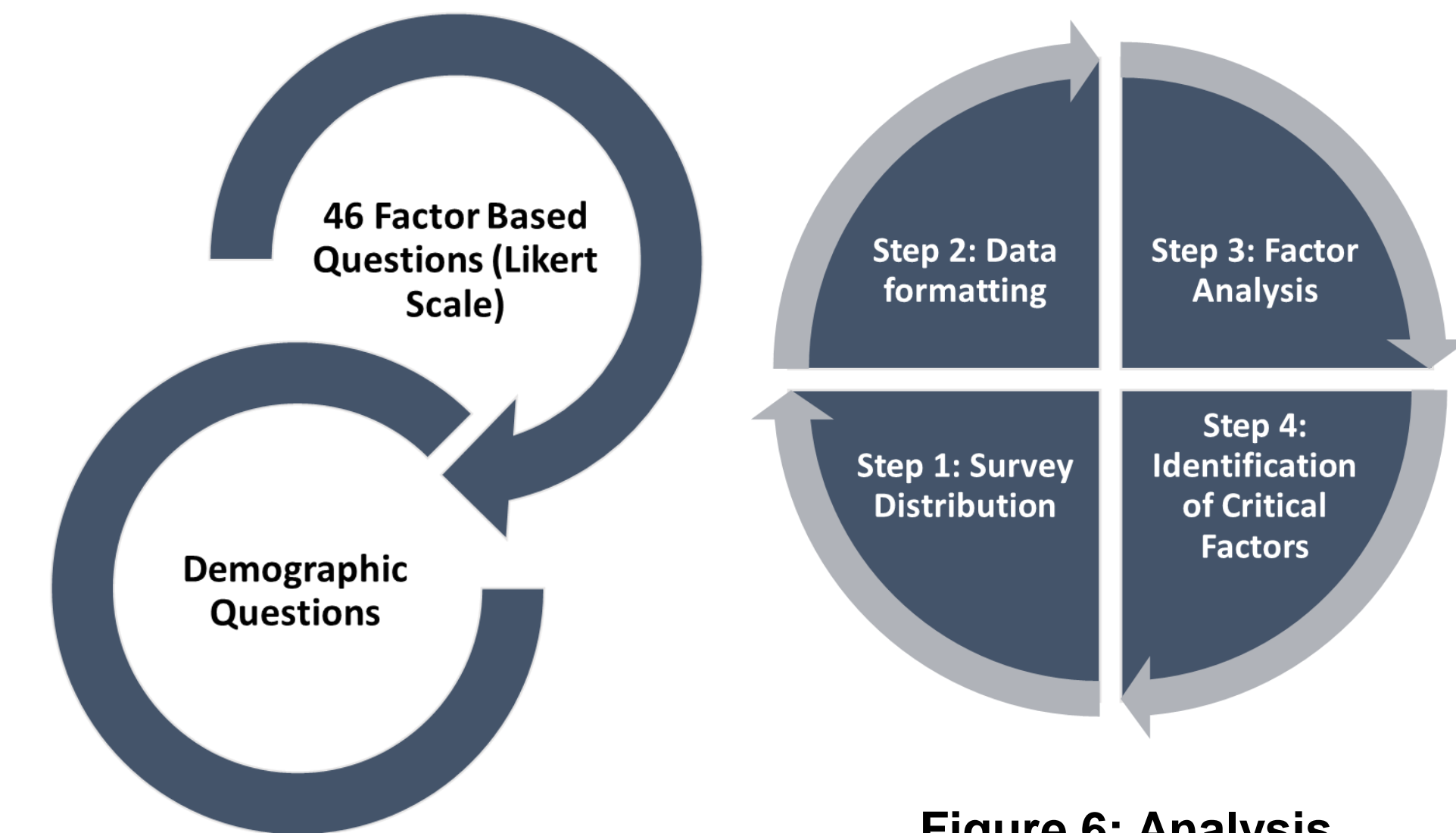


Figure 5: Survey Components

Figure 6: Analysis Methodology

## Expected Outcome

- Quantification of critical consciousness factors and interrelationship in between the factors.
- Identification of critical factors which are important for civil engineering students required to be perceived while studying
- Development of a scale which eventually can be applied for civil engineering education
- Development of engineering curriculum which can be used to increase civil engineering students' critical consciousness

## Practical Contribution

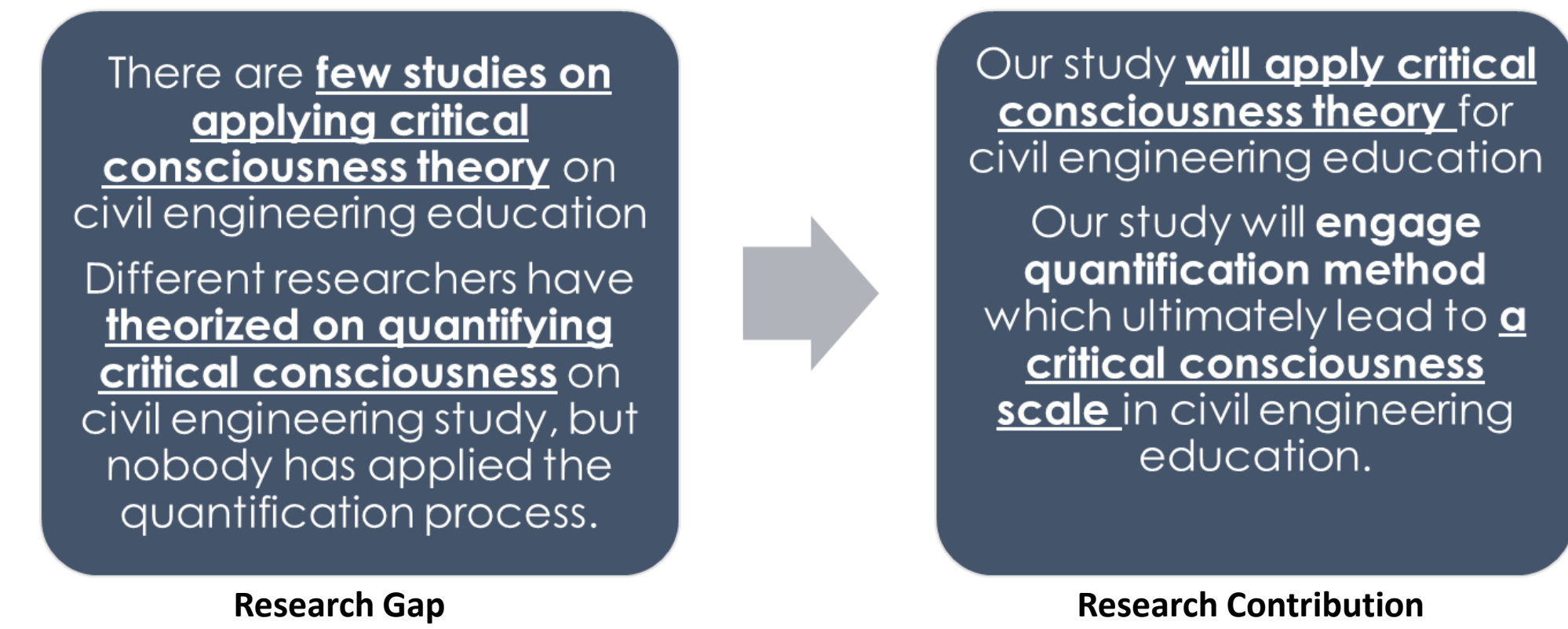


Figure 7: Balance between knowledge gap and contribution

- Our study aims to fulfill ABET's Civil Engineering Education goal which aims to foster the learning outcome of education related to "global, cultural, social, environmental, and economic factors", aiming to make the engineers as "critical thinker."
- This research will enhance the ability to recognize ethical and professional responsibilities in engineering situations
- Engineering community able to perform informed judgement, can consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

## Acknowledgement

This material is based in part on work supported by the National Science Foundation Award No: 1856570. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation (NSF).

